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Modal parameter estimation for shape-changing geometric objects

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As a novel advancement in interactive sound synthesis, we would like to change the shape of a finite element model of an instrument and hear how the sound changes in real-time. Traditional modal synthesis methods require computing a new eigendecomposition for each geometric change – a costly computation using today’s hardware. However, by using the modes computed for one geometry to estimate modal frequencies for other nearby geometries, we can instantly hear the effects of changing the instrument shape on the sound produced. In this talk, we describe the process of estimating resonant frequencies of an instrument by combining information about the modes of similar instruments. We also propose a method for transferring the modal information from one finite element mesh to another. This method is used in situations where severe modifications to the object’s geometry distort the finite element mesh and require an entirely new mesh to be created. We also describe the balance between computational speed and numerical accuracy of the computed resonances.